

A Proposed Data Processing Method for Isobaric Heat Capacity Measurements by the Heat Relaxation Method for Fluids and Fluid Mixtures

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We have developed a new calorimeter for measurements of isobaric heat capacity for fluids and fluid mixtures at high temperatures and pressures by the heat relaxation method. A new data processing method applicable to this calorimeter is proposed in this study. The calorimeter is a batch type and is a pressure vessel with a heater and platinum resistance thermometers. It is connected with a metal-bellows volumometer which makes it possible to keep the sample pressure constant and to measure density of the sample simultaneously. The calorimeter and volumometer are immersed in a thermostatted oil bath whose temperature is kept constant. A sample loaded into the calorimeter is heated with constant heat flow rate by the heater in the calorimeter and the temperature difference between the sample and thermostatted oil bath is measured by the platinum resistance thermometer in the calorimeter. After the sample temperature difference arrives at steady state, heat flow is stopped. Then temperature of the sample decreases and its cooling curve is measured. Analyzing this cooling curve, we can estimate surface temperature of the inner wall of the vessel at the steady state condition. We found that the relation between this temperature and the heat flow rate released from the sample is independent of substances. This relation has been calibrated by water in this study. By the calibration curve we can calculate the isobaric heat capacity of the sample fluid based on the cooling curve measured.